and labor cost data for a given period are not available until 60-90 days into the next, DOE determines a provisional ceiling charge to be used for billing purposes early in the current period. If the provisional ceiling charge is less than the published price, Requirements customers are invoiced at the provisional ceiling charge. When the final labor and power cost statistics are available, DOE computes the actual ceiling charge for the period and adjusts the invoices accordingly.

The most obvious effect of DOE's SWU price increases is to raise the cost of enriched uranium. Although DOE operates the enrichment facilities at a tails assay of 0.25 percent U_{235}, AFC contracts allow the customer to specify, within limits, the transaction tails assay. This "variable tails assay" option (VTAO) gives those customers the freedom to more closely approximate the optimum tails assay.

The optimum tails assay is the tails composition at which the cost of enriched uranium is lowest for given costs of separative work (SWU) and natural uranium feed. It depends only on the *ratio* of the cost of a kilogram of natural uranium in the form of UF_6 to the cost of a kilogram unit of separative work. For a gaseous diffusion plant, there is an exact mathematical relationship:

$$\frac{C_f}{C_s} = (2X_f - 1)\log_e\left(\frac{X_f(1 - X_o)}{X_o(1 - X_f)}\right) + \frac{(X_f - X_o)(1 - 2X_o)}{X_o(1 - X_o)}$$

Where C_f is the cost of feed, C_s is the cost of a SWU, X_f is feed enrichment as a fraction, i.e. 0.00711, and X_o is the optimum tails assay as a fraction.

The above relationship is customarily solved graphically rather than analytically. The equation is plotted in the *Statistical Data* section of each month's Report. To use the plot, it is necessary only to calculate the ratio C_f/C_s and locate the corresponding optimum tails assay on the curve.

Effective October 1, 1981, the cost of separative work under fixed commitment contracts was raised to $130.75/SWU, while the cost of uranium feed remained stable. Given the relatively higher cost of enriching services, the optimum tails assay must increase. This higher tails assay would use more feed uranium and less separative work, minimizing the overall cost of enriched uranium needed to fabricate nuclear fuel.

For example, using this month's Exchange Value of $23.50 per pound U_3O_8 and this month's Conversion Value of $1.10 per pound U as UF_6 yields a feed price of $63.83 per kg U as UF_6. Therefore, the ratio C_f/C_s is $63.83/$130.75, or 0.49. The corresponding optimum tails assay, read from the figure, is approximately 0.31 percent U_{235}.

The optimum tails assay determined above is only a theoretical optimum. Even given fixed costs of separative work, the optimum tails assay still varies from one utility to another, depending on that utility's feed and conversion costs. Utilities customarily account for feed and conversion on the basis of historical cost, but they could use market value instead. Once the decision is made to use historical cost, it is not so obvious whether to use FIFO, LIFO, average cost of all feed presently held in inventory or actual cost of feed passing into the enrichment cascade during a given period. These difficulties are especially significant now, when there are large variations among the prices for current deliveries, the prices of material held in inventories and the price a utility could obtain on a resale. Even though the theoretical determination of optimum tails assay may be quite precise, application of the theory is most dependent upon the values assigned to the supposedly independent variables of U_3O_8 price and conversion price.

Finally, even if the above conflicts can be resolved, it is not necessarily true that a utility should operate at its optimum tails assay. DOE requires advance notice of customers' election of VTAO, so it may not be feasible to maintain optimum tails assay as prices change. Furthermore, it may be advisable for a utility to use a transaction tails assay well below optimum in order to avoid cancellation charges for excess SWU's under contract.

Given the past enrichment and natural feed price movements, the optimum tails assay can be expected to follow an upward trend. If AFC customers select higher transaction tails assays, the result will be an increase in natural uranium consumption over what it would have been at the operating tails assay of 0.20 percent U_{235}, which is also the transaction tails assay for Requirements contracts. For every one-hundredth of a percentage point increase in the transaction tails assay, uranium consumption increases about two percent in order to produce the same amount of enriched uranium. A higher average transaction tails assay would, therefore, mitigate some of the decrease in demand which has occurred over the past few years.

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FORECAST OF APPARENT FUTURE CONSUMPTION

This Report presents Nuexco's forecasts of Apparent Future Consumption of U_3O_8 and installed nuclear electric generating capacity, as of October 31, 1981. (As used by Nuexco, the term "consumption" refers to U_3O_8 entering the pipeline for fabrication into nuclear fuel.) Details of the forecasts are shown in Tables 3 and 4.

This forecast differs only slightly from that presented in Report 147, reflecting a substantially smaller change than might have been expected based on the public record. Virtually all of the cancellations and

Table 3

APPARENT FUTURE CONSUMPTION[1]
(millions of pounds U_3O_8)

BUYER GROUP	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
United States										
Reactors Now Operational	17.9	17.8	18.4	18.6	18.8	18.9	18.8	18.7	18.6	18.4
Now Under Construction	2.7	3.6	9.8	11.0	12.6	17.2	15.4	18.9	15.3	22.0
Now on Order	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—
US Subtotal	20.6	21.4	28.2	29.6	31.4	36.1	34.2	37.6	33.9	40.4
Europe										
Reactors Now Operational	17.3	16.8	17.7	18.4	18.8	18.9	18.9	18.4	17.6	17.1
Now Under Construction	6.5	8.8	18.8	14.2	16.1	20.6	20.4	23.1	20.2	20.3
Now on Order	—0—	—0—	—0—	—0—	—0—	—0—	—0—	8.8	5.4	5.9
Europe Subtotal	23.8	25.6	36.5	32.6	34.9	39.5	39.3	50.3	43.2	43.3
Far East[2]										
Reactors Now Operational	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.0	2.9	2.8
Now Under Construction	2.4	3.8	2.2	9.3	8.0	5.6	6.8	6.2	5.2	4.8
Now on Order	—0—	—0—	—0—	—0—	—0—	1.1	0.3	1.4	0.5	0.4
Far East Subtotal	6.0	7.3	5.6	12.7	11.3	9.9	10.2	10.6	8.6	8.0
Other Free World[3]										
Reactors Now Operational	2.1	2.1	2.1	2.1	2.0	2.0	1.9	1.8	1.8	1.7
Now Under Construction	0.2	2.4	3.8	3.2	3.2	4.1	4.3	3.6	3.0	3.4
Now on Order	—0—	—0—	—0—	—0—	—0—	0.7	0.6	0.4	0.7	1.1
Other Subtotal	2.3	4.5	5.9	5.3	5.2	6.8	6.8	5.8	5.5	6.2
FREE WORLD[3] TOTAL	52.7	58.8	76.2	80.2	82.9	92.3	90.5	104.3	91.2	97.9
WORLDWIDE BREAKDOWN BY STATUS										
Reactors Now Operational	40.9	40.2	41.6	42.5	42.9	43.0	42.7	41.9	40.9	40.0
Now Under Construction	11.8	18.6	34.6	37.7	39.9	47.5	46.9	51.8	43.7	50.5
Now on Order	—0—	—0—	—0—	—0—	—0—	1.8	0.9	10.6	6.6	7.4

[1]Computed quantities of U_3O_8 which would be used under the given conditions to fabricate fuel for loading and reloading reactors operating, under construction or on order as of October 31, 1981. Compiled and computed on a reactor-by-reactor basis, quantities for each reactor are based on specific core characteristics, 0.25% tails assay, no recycling, 24-month lead time for procuring first cores and 18-month lead time for procuring each reload. Where reload schedule is not already known, these estimates assume reloads occur one year after commercial operating date and annually thereafter. Nuexco estimates of individual reactor capacity factors are used.

[2]Japan, Korea, People's Republic of China, Taiwan.

[3]Excludes Bulgaria, Czechoslovakia, German Democratic Republic, Finland (two Russian Reactors), Hungary, Poland, Romania, USSR.

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schedule delays which have been announced in the past year had already been incorporated into the forecast published in Report 147.

Methodology

The methodology used in developing the forecasts detailed in Tables 3 and 4 is summarized below:

1. Tails assay is assumed to be 0.25 percent U_{235}. For each increase of 0.05 percent U_{235} in the tails assay, reactor consumption rises by approximately nine percent.

2. Capacity factor for each reactor is forecast according to elapsed time since that reactor's date of commercial operation. The method is based upon the application of historical capacity factor data to a power curve of the form,

$$y = a\ x^b$$

Table 4

NUCLEAR ELECTRIC GENERATING CAPACITY[1] [2]
(thousands of MWe—net)

BUYER GROUP	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
United States										
Reactors Now Operational	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0
Now Under Construction	—0—	3.9	8.4	14.1	23.0	28.2	34.8	41.9	47.8	54.3
Now on Order	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—
US Subtotal	56.0	59.9	64.4	70.1	79.0	84.2	90.8	97.9	103.8	110.3
Europe										
Reactors Now Operational	48.3	48.1	48.1	48.0	48.0	47.4	47.4	47.1	45.4	43.9
Now Under Construction	0.9	10.7	20.1	25.7	37.6	43.3	47.5	54.9	61.0	66.7
Now on Order	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	9.1
Europe Subtotal	49.2	58.8	68.2	73.7	85.6	90.7	94.9	102.0	106.4	119.7
Far East[3]										
Reactors Now Operational	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8
Now Under Construction	—0—	0.9	4.7	7.2	8.1	15.7	19.6	20.5	22.2	23.1
Now on Order	—0—	—0—	—0—	—0—	—0—	—0—	—0—	1.1	1.1	2.1
Far East Subtotal	16.8	17.7	21.5	24.0	24.9	32.5	36.4	38.4	40.1	42.0
Other Free World[4]										
Reactors Now Operational	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Now Under Construction	—0—	0.6	2.6	5.9	9.0	10.4	12.0	13.5	14.7	14.7
Now on Order	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	1.5	2.4
Other Subtotal	6.7	7.3	9.3	12.6	15.7	17.1	18.7	20.8	22.9	23.8
FREE WORLD TOTAL	128.7	143.7	163.4	180.4	205.2	224.5	240.8	259.1	273.2	295.8
WORLDWIDE BREAKDOWN BY STATUS										
Reactors Now Operational	127.8	127.6	127.6	127.5	127.5	126.9	126.9	126.6	124.9	123.4
Now Under Construction	0.9	16.1	35.8	52.9	77.7	97.6	113.9	130.8	145.7	158.8
Now on Order	—0—	—0—	—0—	—0—	—0—	—0—	—0—	1.7	2.6	13.6

[1]Installed as of year end.
[2]Uses Nuexco estimates of commercial operating dates.
[3]Japan, Korea, People's Republic of China, Taiwan.
[4]Excludes Bulgaria, Czechoslavakia, German Democratic Republic, Finland (two Russian reactors), Hungary, Poland, Romania, USSR.

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Table 5

COMPARISON OF THIRTY YEAR URANIUM REQUIREMENTS (MTU/GWe) FOR PWR PLANTS OF CURRENT AND IMPROVED DESIGN BETWEEN INFCE[1] AND NUEXCO[2]

		Nuexco Assumption for Plants Operating in:		INFCE Improved Design Leading to Uranium Savings of:	
	Current Design	1985	1990	15%	30%
INFCE[1] (MTU/GWe)	4,350			3,700	3,040
Nuexco[2] (MTU/GWe)	4,350	4,200	3,930		
Relative Improvement (%)	Base	3.4	9.7	15	30

[1]International Nuclear Fuel Cycle Evaluation, International Atomic Energy Agency, Vienna, 1980: Volume 8, Advanced Fuel Cycle and Reactor Concepts, Report of INFCE Working Group 8, pages 53-67. Adapted from Table V (page 67).
[2]Nuexco data normalized to INFCE conditions.

where:

y = annual capacity factor in percent;

x = years since date of commercial operations;

a and b are empirically determined constants.

It is a commonly held belief that achievable capacity factor varies with reactor size. Nuexco grouped the world's reactors according to region and type (US LWR's, CANDU's, European LWR's, AGR's, etc.)

Applying a simple regression analysis to historical operating data, Nuexco determined the constants *a* and *b* for each grouping of reactors. In the range of 150 MWe to 1,250 MWe, differences in reactor size had no significant effect on capacity factor, within the limits of the analysis. Using this method of predicting capacity factor reduces forecast consumption by a worldwide average of approximately ten percent.

3. Reactor physics improvements are incorporated into the forecast as indicated in Table 5.

The two principal forces stimulating the development of more efficient fuel are:

a. Competition among fuel fabricators, particularly for reload fuel orders. This has led to more efficient fuel designs being proposed by the fabricators.

b. The trend toward refueling cycles of eighteen months or longer.

Each of these forces acts to increase the energy content in a given fuel rod. The effect is to reduce the uranium weight in the fuel rod or to increase the average fuel exposure or both. Of course, these changes lead to increases in average levels of enrichment and in the average expected capacity factor. Thus, essentially all important variables in the uranium consumption calculation for reload fuel (and initial core fuel to a lesser extent) will change. These changes in fuel design variables apply to essentially all plants which entered commercial operation after January 1969.

The INFCE report referenced in Table 5 above discusses nine methods for improving uranium utilization in LWR plants:

a. Increased burnup (MWD/MTU)
b. Lattice changes
c. Spectrum shift
d. Enrichment zoning, including blankets
e. Full use of early batches of startup core
f. Improved fuel management and control design
g. End-of-cycle coastdown
h. Reconstitution inversion of BWR fuel
i. Increased frequency of refueling

The INFCE report postulated improvements ranging from 15 to 30 percent. Nuexco, believing that the INFCE targets were too optimistic for general application to LWR plants, chose to use improvements of 3.4 percent by 1985 and 9.7 percent by 1990, as shown above. Nuexco's assumption of modest improvements in uranium utilization was implemented wholly by increasing fuel exposure. The forecast discounted the other eight areas of fuel improvement potential.

A similar approach was followed for heavy water reactor plants where modest improvements in uranium utilization were assumed by 1985, but larger gains were instituted by 1990 through the use of

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slightly enriched uranium (1.20 percent U^{235}) in reload fuel. For conservatism, no improvements were assumed for gas-cooled reactor plants.

4. Factors considered in forecasting additions to installed capacity are:

a. Construction progress to date for individual nuclear plants, and the owner utility's construction experience for conventional as well as nuclear units;

b. The owner utility's financial condition and the estimated likelihood of relief from ratemaking bodies;

c. Forecasts of growth in demand for electricity;

d. Societal constraints, such as the active opposition of anti-nuclear pressure groups;

e. Institutional constraints, such as the US NRC caseload.

5. Uranium is deemed to have been consumed when it has entered the enrichment-fabrication pipeline for ultimate use in a reactor.

6. Reactor loading is calculated for each reactor type, based on its particular reactor physics.

7. The forecasts assume that:

a. U_3O_8 deliveries for first cores predate commercial operation by two years;

b. U_3O_8 delivery for each reload predates refueling outage by 18 months.

8. Using the assumptions listed above, the consumption for a given reactor can be computed as a function of capacity factor, tails assay and commercial operating date.

9. Actual commercial operating dates can vary widely from published dates. Nuexco uses the best information available, much of it from unpublished sources, to prepare its own forecasts of operating dates. Such information often changes more frequently than does public information; Nuexco attempts to anticipate such changes as much as possible.

Limitations

Limitations of the forecasts detailed in Tables 3 and 4 are as follows:

1. Forecasts of Apparent Future Consumption are not forecasts of actual uranium demand. Rather, these forecasts comprise a portion of uranium demand more commonly referred to as reactor demand or reactor requirements. As indicators of the amount of uranium which will be needed to fuel the reactors under consideration, these forecasts should be regarded as relatively hard demand in the sense that this portion of demand is quite insensitive to uranium prices. Market demand for the assumed pattern of capacity additions can be higher or lower, depending on user's inventory policies.

2. Factors which can cause demand to exceed Apparent Future Consumption are:

a. Utility buyers plan their procurement strategies to achieve a very high probability of having access to at least enough uranium to meet commitments as they arise;

b. Accelerated reactor construction schedules can advance the dates of uranium need;

c. Buyers may elect to purchase uranium in excess of need, simply to enhance security of supply;

d. Utility obligations to suppliers of fuel cycle services such as conversion, enrichment or fabrication, may require earlier purchase of uranium than a reactor's operating schedule would otherwise indicate.

3. Demand can fall short of Apparent Future Consumption if uranium inventories are reduced in order to fill needs which would otherwise appear as demand.

4. These forecasts make no provision for orders not yet placed. Only the consumption associated with reactors operating, under construction or on order are included.

5. Reactors fueled by the USSR are excluded from Nuexco's forecasts. Although Soviet bloc reactors account for substantial demand, Soviet participation in uranium trading in the Western market has been negligible and appears likely to remain so.

SUPPLY AND DEMAND ANALYSIS

The supply-demand analysis resulting from Nuexco's most recent forecasts of production and consumption of uranium is presented in Table 6 (WOCA) and Table 7 (US). Conclusions which may be drawn from the analysis include the following:

1. Table 6 shows forecast production exceeding forecast consumption in each year through 1990, implying that supply and demand will be balanced by an annual net increase in inventory. In actual practice, if supply exceeded demand over an extended period, the necessary balance would probably result from a combination of inventory purchases and reduced production.

2. The forecast inventory of approximately 426 million pounds of U_3O_8 equivalent as of January 1, 1982 represents slightly more than five years of forward

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Table 6

URANIUM SUPPLY-DEMAND BALANCE: WOCA[1]
(millions of pounds U_3O_8)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
PRODUCTION[2]										
Operating Production Centers	110.6	100.4	95.5	91.4	85.1	79.8	81.0	80.6	80.5	79.4
Facilities Under Construction	0.4	9.4	11.1	12.8	14.3	14.3	14.1	14.1	14.1	14.1
Planned Facilities	—0—	—0—	—0—	3.6	8.4	9.6	9.6	13.6	13.6	13.6
Total	111.0	109.8	106.6	107.8	107.8	103.7	104.7	108.3	108.2	107.1
less										
CONSUMPTION[3]	52.7	58.8	76.2	80.2	82.9	92.3	90.5	104.3	91.2	97.9
equals										
NET INVENTORY INCREASE	58.3	51.0	30.4	27.6	24.9	11.4	14.2	4.0	17.0	9.2
plus										
BEGINNING INVENTORY	367.8[4]	426.1	477.1	507.5	535.1	560.0	571.4	585.6	589.6	606.6
equals										
ENDING INVENTORY	426.1	477.1	507.5	535.1	560.0	571.4	585.6	589.6	606.6	615.8
RELATIVE INVENTORY (years)[5]	5.2	5.4	5.5	5.6	5.8	5.9	5.9	6.0	6.1	6.2

[1]World outside Communist areas
[2]Nuexco Report 158, Table 3
[3]This Report, Table 3
[4]Nuexco estimate
[5]For each year, Relative Inventory equals the number of years' forward consumption which could be supplied by that year's Beginning Inventory.

consumption. Inventory will increase steadily throughout the decade until it reaches approximately 600 million pounds U_3O_8 equivalent by 1990. Relative inventory is quite stable, however, increasing gradually from 5.2 years' forward consumption in 1981 to 6.2 years' forward consumption in 1990.

3. If actual demand is to be sufficient to support production from other production centers planned, but not yet under construction, it may arise from new reactor orders, or from political or national policy considerations. However, it is more likely that a major driving force behind any such additional production entering the market would be the displacement of other higher-cost production centers.

Table 7 shows Nuexco's analysis of forecast uranium supply and demand balance for the US. By reviewing the US situation alone, any potential market for imports or new US production can be identified. The analysis in Table 7 is of the same basic form as that of Table 6 (WOCA), but the US analysis includes an adjustment for *firm* US import-export commitments. The current US import-export balance is summarized in Table 8. Based on the US supply-demand balance, it may be concluded that:

1. In the US, consumption is forecast to exceed production annually, beginning in 1983. Forecast uranium production in 1985 is approximately one-half the 1981 domestic production, whereas Apparent Future Consumption increases by more than 50 percent between 1981 and 1985. By 1990, that ratio drops to 37 percent.

2. Table 7 shows an annual US supply deficit beginning in 1983 and rising to more than 25 million pounds U_3O_8 by 1990. Without additional imports or more US production, US inventory would decline to a level equivalent to approximately 18 months' forward consumption by 1990.

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Table 7

URANIUM SUPPLY-DEMAND BALANCE: US
(millions of pounds U_3O_8)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
PRODUCTION[1]										
Operating										
Conventional Mills	28.7	19.6	15.9	14.1	12.7	9.7	9.7	9.3	9.3	8.8
Unconventional Sources	7.2	7.7	6.8	5.5	5.1	5.1	5.1	5.1	5.1	4.3
Subtotal	35.9	27.3	22.7	19.6	17.8	14.8	14.8	14.4	14.4	13.1
Under Construction										
(as of 9-30-81)	0.3	0.6	0.7	0.7	0.7	0.7	0.5	0.5	0.5	0.5
Shutdown or Cancelled										
(as of 9-30-81)	1.0	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—
Total	37.2	27.9	23.4	20.3	18.5	15.5	15.3	14.9	14.9	13.6
less										
CONSUMPTION[2]										
Reactors now Operational	17.9	17.8	18.4	18.6	18.8	18.9	18.8	18.7	18.6	18.4
Now Under Construction	2.7	3.6	9.8	11.0	12.6	17.2	15.4	18.9	15.3	22.0
Now on Order	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—
Total	20.6	21.4	28.2	29.6	31.4	36.1	34.2	37.6	33.9	40.4
plus										
NET IMPORTS (EXPORTS)[3]	(2.1)	0.7	0.8	2.6	0.4	1.9	1.0	1.4	1.5	1.5
equals										
SUPPLY SURPLUS (DEFICIT)	14.5	7.2	(4.0)	(6.7)	(12.5)	(18.7)	(17.9)	(21.3)	(17.5)	(25.3)
plus										
BEGINNING INVENTORY[4]	147.8	162.3	169.5	165.5	158.8	146.3	127.6	109.7	88.4	70.9
equals										
ENDING INVENTORY	162.3	169.5	165.5	158.8	146.3	127.6	109.7	88.4	70.9	45.6
RELATIVE INVENTORY[5] (yrs.)	5.5	5.5	5.3	4.9	4.6	4.1	3.5	2.9	2.3	1.8

[1]Nuexco Report 158, Table 1
[2]Nuexco Report 157, Table 6
[3]This Report, Table 8
[4]"US Uranium Market Developments"; S. Victoria Krusiewski and David C. Thomas; US DOE; Grand Junction, Colorado; October 1981.
[5]For each year, Relative Inventory equals the number of years' forward consumption which could be supplied by that year's Beginning Inventory.

Methodology

1. The two most critical assumptions in this type of analysis are:

a. Outside the US, supply and demand will be balanced by inventory accumulation and increased exports to the US, rather than by reducing production.

b. In the US, supply and demand will be balanced by inventory liquidation and increased imports, rather than by reducing consumption. It is very possible that some US utilities' preference for domestic supply will induce them to subsidize some otherwise uneconomic US production, but Nuexco's interpretation of US utilities' attitudes indicates that this effect will be neither widespread nor substantial.

2. Another critical variable in the supply-demand analysis is the degree to which producers having

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Table 8

US IMPORT-EXPORT BALANCE
(millions of pounds U_3O_8)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
IMPORTS										
Annual	7.1	7.1	5.9	6.2	3.6	3.7	2.8	2.8	2.8	2.8
Cumulative	7.1	14.2	20.1	26.3	29.9	33.6	36.4	39.2	42.0	44.8
EXPORTS										
Annual	9.2	6.4	5.1	3.6	3.2	1.8	1.8	1.4	1.3	1.2
Cumulative	9.2	15.6	20.7	24.3	27.5	29.3	31.1	32.5	33.8	35.0
NET IMPORTS (EXPORTS)										
Annual	(2.1)	0.7	0.8	2.6	0.4	1.9	1.0	1.4	1.5	1.5
Cumulative	(2.1)	(1.4)	(0.6)	2.0	2.4	4.3	5.3	6.7	8.2	9.7

existing contracts will elect to purchase rather than produce uranium. This applies especially to US producers, since the average cost of production in the US is so high.

3. Forecasts of Apparent Future Consumption take no account of planned reactors or any reactors not yet ordered. Consequently, consumption forecasts will understate actual demand by the amount attributable to unordered reactors.

4. Inventory refers to uranium (U_3O_8, natural UF_6, enriched UF_6) owned by utilities, reactor manufacturers, fuel fabricators and national organizations which procure uranium for commercial purposes. The inventory amounts do not include strategic stockpiles, such as those owned by the US DOE. Difficulties in accounting precisely for the variety of possible forms, location and ownership of inventory necessarily result in some uncertainty in estimating total world inventory. Nuexco's estimate of worldwide inventory as of the beginning of 1981 is approximately 426 million pounds U_3O_8 equivalent; however, the uncertainty factor of this estimate is ten to fifteen percent. More important is the fact that the primary conclusions of this analysis are not sensitive to beginning inventory variations of ten to fifteen percent.

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THE EXCHANGE VALUE: WHAT IT IS AND WHAT IT IS NOT

The decline in uranium prices during the past two and one-half years has focused increasing attention on the Exchange Value and its role as an indicator of uranium prices. This essay attempts to clarify what the Exchange Value is and what it is not.

Definition of Exchange Value

The Exchange Value, its definition and explanatory notes appear in each month's Report.

Definition

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

Derivation

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.

B. Data from pending transactions.

C. Firm bids to buy and firm offers to sell.

D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

Comments

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.

B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

Evolution of the Definition

The Exchange Value has been published monthly since August 1968. Although Nuexco has adapted the definition in response to changing market conditions and to the quantity and quality of information available, the Exchange Value has, since its inception, been subjective in nature reflecting the judgment of Nuexco's senior staff. It describes, by means of price, the state of the uranium market as of the publication date of each Report.

The modifications in the definition of Exchange Value are numerous, but can be conveniently divided into three major phases.

a. For the first five years of the Nuexco Monthly Report (August 1968-October 1973), the various definitions of Exchange Value all reflected the existence of a buyer's market. Sellers competed aggressively for limited business, so they kept prices down. Exchange Values were strongly influenced and sometimes solely determined by the lowest price at which a producer would offer material for sale. Buyers would then usually be able to negotiate downward; this process yielded transaction prices which were below then current Exchange Value.

b. The second phase, the seller's market, lasted from November 1973 through May 1978. It would be too simplistic to suggest that the shift from a buyer's market to a seller's market could be placed so precisely in time, but for purposes of analysis it is convenient to define the period by Nuexco's revision of the Exchange Value definition in recognition of that shift.

During the seller's market, buyers competed aggressively for limited supplies and prices were driven up steeply. Exchange Values were largely determined by the highest price at which a buyer would bid to begin negotiations. Sellers would then usually be able to negotiate upward, yielding transaction prices which were typically above then current Exchange Values.

c. The third phase (June 1978-present) began with a shift to a balanced market. In response to that shift, Nuexco revised the definition of Exchange Value to reflect input from buyers' bids, sellers' offers and transactions. The result is a definition which encompasses whatever relevant price information is available. In a buyer's market, there will be very few, if any, buyers' bids; in a sellers' market, there will be few sellers' offers, if any. The versatility of the current definition has been demonstrated in that while this third phase has seen substantial strengthening of the buyers' bargaining position—the market could now be best described as a buyers' market—the current definition of Exchange Value, adopted in June 1978, has served throughout the period.

For those readers who are interested, Nuexco has prepared a history of the Exchange Value which chronicles, month-by-month, changes in the definition, usage and derivation. Copies are available upon request.

Data Not Included

Certain data are excluded in determining the Exchange Value, namely, that price data associated with

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(a) uranium delivered or to be delivered under old contracts, (b) uranium delivered under transactions that are not arm's length, and (c) uranium delivered as a consequence of contract renegotiations. Such exclusions include those prices that result from periodic negotiations under so-called "market price" type contracts. These prices are excluded because they are neither arm's length nor current. By definition, a prior contractual arrangement exists. Also excluded from consideration are *all* data where the future delivery price is defined in such a way that it cannot currently be determined, regardless of whether such data arise out of contracts, bids, offers or other sources. This exclusion applies particularly to contracts in which future delivery prices are expressed as a function of Exchange Value or any other independent variable.

Misinterpretations of Exchange Value

Although it should be self-evident, it is necessary to reiterate that the Exchange Value is no more than its definition. It is neither a quote nor a spot price, nor a near-term price, nor a long-term contract price. It is merely the Exchange Value.

Despite the specific language used to define it, media and industry usage has frequently attributed additional characteristics to the Exchange Value. Thus, a number of terms have been used in reference to the Exchange Value, describing it variously as "the market quote," "the spot price," "the market price," "the fair market price," "the world market price," "the fair world market price," and "the contract price." Uncritical acceptance of such terms and their implications has caused some confusion within the uranium industry, particularly as uranium prices have declined.

The recent decline in uranium prices has led to a situation in which the Exchange Value is lower than the production costs of some producers. While the drop in the Exchange Value is understandably distressing to producers (particularly to those having high production costs) it must be noted that the Exchange Value *in no way* relates to or defines cost of production; nor does it reflect the price level needed to provide a minimum acceptable rate of return on investment.

Exchange Value Is Not the Market Price

When used in reference to the uranium market, the term "market price" is so imprecise as to be meaningless. For example, for the calendar year 1980: (a) the average Exchange Value was $31.79 per pound U_3O_8; (b) the weighted average price reported by US DOE was $28.15 per pound U_3O_8; (c) individual buyers paid as little as $13.00 per pound U_3O_8 or as much as $59.00 per pound U_3O_8 for deliveries under long-term contracts. Given this data, one might reasonably be confused by the question, "What was the market price during 1980?" Clearly the Exchange Value is not the market price.

Without general industry agreement, the words "market price" have meaning only to the individual using them, or to the extent these words are specifically defined in a particular contract. If seller X and buyer Y agree to define "market price" in a given manner, they do so for their own purposes. Such agreement does not, however, constitute or imply more universal acceptance of their definition. On the contrary, reference to publicly available contracts will demonstrate that there are nearly as many different definitions of "market price" as there are contracts.

Exchange Value As One Indicator of Spot Prices

It is Nuexco's opinion that, at any given time, there is general agreement as to the approximate level of spot prices. Opinions may differ somewhat, but active market participants' estimates of spot market price levels will fall into a rather small range.

Three published measures—Nuexco's Exchange Value, Nuexco's Transaction Value and Nukem's spot market price range—are generally regarded as indicators of spot market price levels. Even though they are defined differently and are derived independently, comparisons of the three measures show that they yield very similar results. Consequently each of the three measures reinforces the validity of the other two as indicators of natural uranium spot market price levels.

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KEY LAKE PROJECT — PART II

Project Development

The development of the Key Lake uranium deposits represents the largest planned industrial project ever undertaken in northern Saskatchewan. The Key Lake Mining Corp. (KLMC) will invest about US $400 to $500 million for mine development and mill construction to recover a maximum of 12 million pounds U_3O_8 per year during a project life of 15 to 20 years. Uranium production will originate primarily from the Gaertner and Deilmann ore deposits; small satellite deposits known to occur along the trend of mineralization may be a source of production in later years. Each KLMC venture partner will receive his pro-rata share of yellowcake production in kind.

The preliminary plans for orebody development were formulated almost concurrently with orebody discovery. In order to complete the exploration and evaluation of each orebody, primarily the Deilmann, it was necessary to devise a plan to overcome certain surface conditions. Some of these aspects of the early planning were eventually incorporated into the final development strategy.

The terrain in the Key Lake area consists of low undulating hills and shallow lakes occurring in a general northeast to southwest trend. The surface is composed of highly weathered, unconsolidated fine to coarse Athabasca Sandstone and glacial debris ranging in particle size from clay-like to boulder-size material. The natural water table is not more than three meters below the ground surface. With these characteristics, access to strategic test drilling areas was limited by loose sand and surface water. The immediate problem of orebody delineation was overcome by lowering the water level of several lakes including Key Lake.

Initially it was necessary to lower the water level of eight lakes to complete delineation of the orebodies and to determine the engineering and economic feasibility of an exploitation plan. The lakes were partially drained by digging a canal system to carry the water northeast where it flowed into a larger river system. The drainage program began in 1978 under government approval relating to the early investigational stage of the project. The approval required that the water level of each lake be returned to the original level and that the natural water conditions be restored if the project did not proceed. As the project develops through several phases, the water level of about 15 lakes will be affected.

The details of project development, including environmental considerations, were formulated between 1977 and 1979. The final plan was submitted for approval to the proper Saskatchewan government agencies by KLMC in October, 1979. All development activity will be restricted to the 25 kilometer area already designated as the project site by the Department of Northern Saskatchewan. Figure 1 compares the original development schedule as proposed by KLMC in October, 1979 with the current schedule of activities. Time delays of three to six months have occurred in certain areas due to slow approval of the surface lease by the Department of Northern Saskatchewan. KLMC intends to bring the mine (Gaertner) and mill into production as originally scheduled regardless of imposed delays. All related work will be accelerated to meet the schedule.

According to the development plan, the Gaertner orebody will be stripped of overburden by first quarter 1983. However, in order to carry out overburden removal it was determined earlier that in addition to lowering the water level of several lakes and completely draining others, dewatering of the overburden would be necessary. The removal of the ground water from the overburden is necessary to provide stability to the undisturbed material for better pit slope control, easier movement of heavy equipment, and for minimizing any mining problems due to the accumulation of excess water at the lowest working levels of the mine. The rate of dewatering is scheduled to proceed overburden removal. Eventually, the ground water level will be maintained below the ore zone.

The initial test pumping for the dewatering process began in April, 1981; formal approval of the dewatering program was granted to KLMC in September. Currently, there are about 30 dewatering wells strategically located in and around the perimeter of the planned Gaertner pit area. The average pumping rate per well is presently maintained at about 200 gallons per minute which is already within 90 percent of the engineering design. Depending on ground water conditions, an estimated 80 to 110 million cubic feet of water will be pumped from the mine area per year to maintain favorable working conditions.

Orebody Development and Mining

The development of the Gaertner orebody is behind the original schedule due to a delay in the final approval of the Environmental Impact Statement.

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RAW MATERIALS

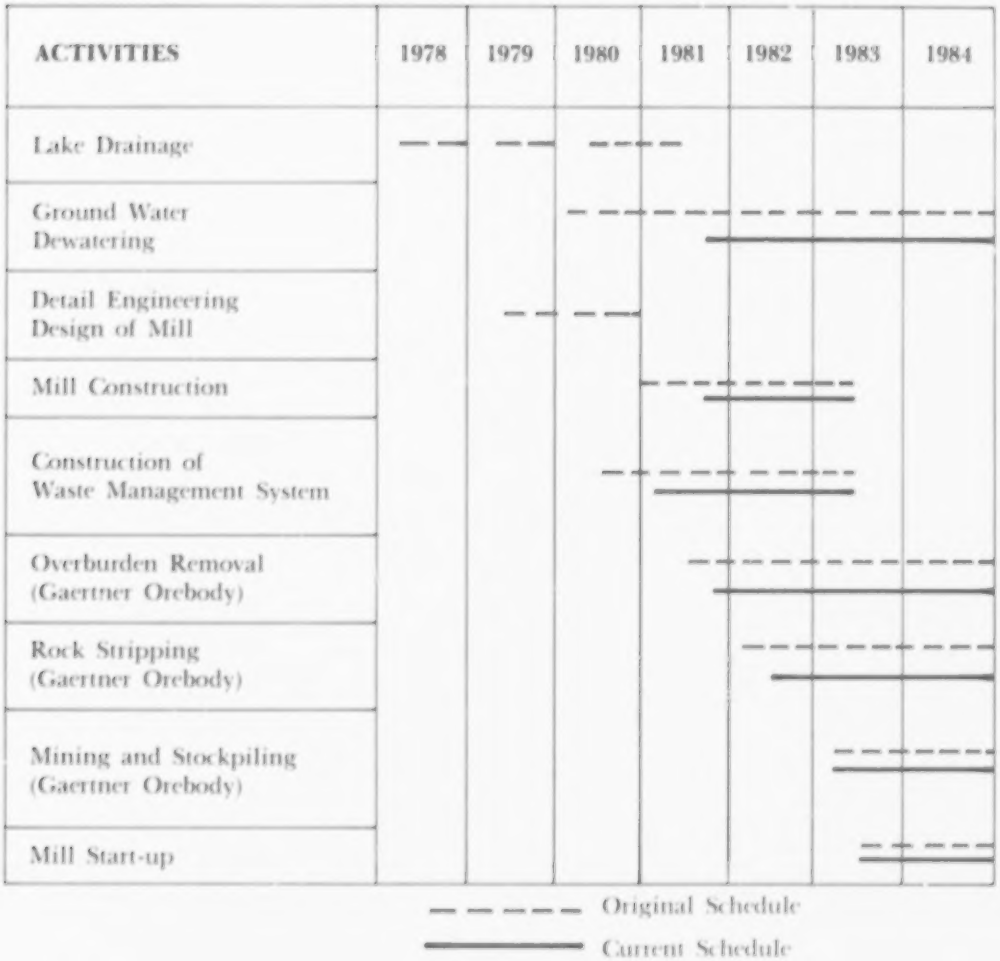

Figure 1

PROPOSED SCHEDULE OF ACTIVITIES RELATIVE TO MINING OF THE GAERTNER OREBODY AND MILL START-UP. THE CURRENT SCHEDULE IS COMPARED TO THE ORIGINAL SCHEDULE OF OCTOBER 1979

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However, contracts for overburden removal are currently under review and the actual stripping operation is expected to begin sometime in December. An estimated 7.7 million cubic meters of overburden will be removed to allow access to the entire orebody, including the cobble ore zone which overlies the main orebody. The eventual pit outline will measure about 1,000 meters long by 380 meters wide at the surface. The thickness of overburden above the cobble ore zone varies from 20 to 60 meters.

Approximately 587,000 tonnes of cobble ore is considered recoverable by present pit design. A large part of the cobble ore will be mined and stockpiled separately before the upper portion of the main orebody is accessible for mining. Mining of the main orebody will follow mining of the cobble ore and the final phase of overburden removal. If the schedule for overburden removal is maintained, mining of the main orebody could begin during the first quarter of 1983. The mining rate will average about 600 tonnes per day throughout the life of the project.

The overburden consists of unconsolidated sand and glacial debris. Rock blasting will not be necessary through the overburden. However, the ore occurs in the lower segment of unweathered and well consolidated Athabasca Sandstone and underlying metamorphic rocks. Both rock types must occasionally be drilled and blasted prior to removal. The majority of the ore will be broken up by dozers equipped with rippers. Figure 2 shows a scraper doing preparatory work on the Gaertner deposit. The unconsolidated nature of the overburden is illustrated.

Mining procedures will follow standard open pit techniques utilizing heavy duty diesel powered scrapers and or shovels for overburden removal. Back-end dump trucks will haul all ore to the surface. All equipment utilized in the mining operation will be constructed with special shielding to protect the operators from excessive radiation in the pit. The overburden will be transported to special waste storage areas, one of which will be located immediately south of the Gaertner pit. Waste from both pits will eventually be stored at this site. Select material will be used in the construction of the mill tailings dam and storage area.

As the ore is mined and hauled to the surface, it will go directly to a primary crusher to be reduced to a uniform size. The crushed ore will then be transported to a stockpile area where it will be tested for uranium content and blended according to a desired grade for mill feed. Careful blending of the crushed ore is essential to project efficiency because of a wide variation in the uranium content throughout both ore deposits. The uranium content is known to vary from a low of 0.10 percent U_3O_8 to a high of 69.0 percent. The average feed to the mill will be maintained at 2.50 percent U_3O_8. Figure 3 shows the layout of the Key Lake project. Note the relationship of the support facilities to the two pits.

Overburden removal from the Deilmann orebody could begin by late 1984 or early 1985. The mining of ore may not begin until 1989 or 1990. The dewatering and stripping of overburden, in addition to general mining procedures, will duplicate the Gaertner project. The long duration of the Deilmann development schedule is based on the fact that an estimated 21 million cubic meters of overburden--almost three times the volume to be removed from the Gaertner orebody—must be removed. Most overburden material will be stored on a select site adjacent to but slightly northeast of the pit area. Surface dimensions of the pit will measure approximately 1,270 meters by 650 meters. The average depth to ore will be 180 meters.

The ore reserves for each deposit were calculated according to the results of a three-dimensional geostatistical computer model prepared by KLMC as part of the total feasibility study. The following tabulation is an estimate of minable reserves for each ore deposit:

Table 9

MINABLE RESERVES OF THE GAERTNER AND DEILMANN DEPOSITS

	Thousands of Tonnes Ore	Percent Grade	Millions of Pounds U_3O_8
Gaertner:			
Main Zone	814	3.30	59.2
Cobble Zone	587	0.54	7.0
Deilmann	2,117	2.49	116.2
Total	3,518		182.4

The above represents an in-place estimate of ore reserves, all of which may not be recoverable. Thus, KLMC has estimated that actual U_3O_8 recovery could

Figure 2

SCRAPER DOING PREPARATORY WORK
ON THE GAERTNER DEPOSIT

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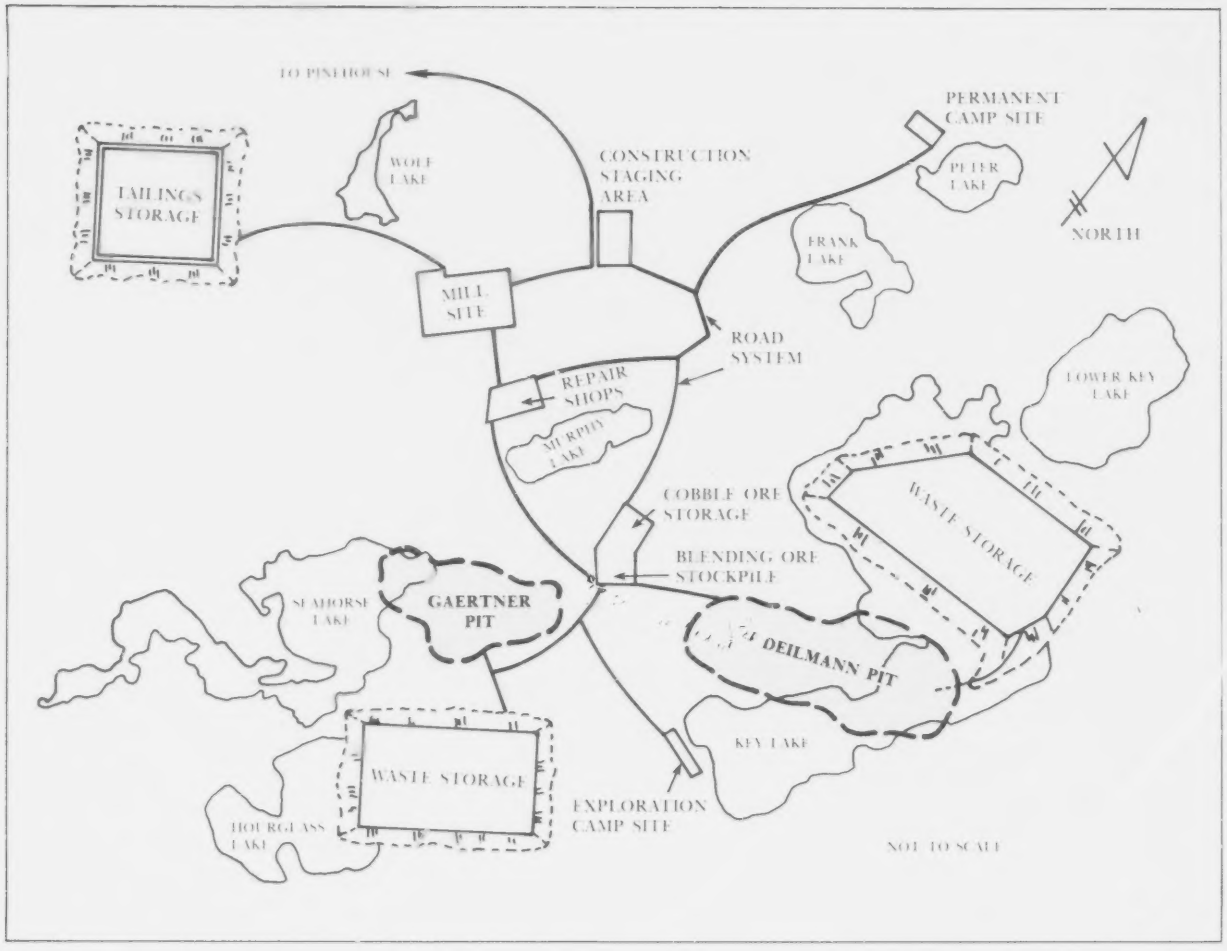

Figure 3

PLANNED LAYOUT OF THE KEY LAKE PROJECT

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vary between 160 and 180 million pounds over the planned production period.

Milling

The milling process will consist of conventional mild-acid leaching, counter current decantation, solvent extraction and ammonia precipitation. Mill design capacity will be 600 tonnes of ore per day to produce up to 12 million pounds U_3O_8 per year. To accomplish the high production rate, uranium recovery efficiency through the mill will be at least 97 percent; the grade of the mill feed will be controlled at 2.50 percent U_3O_8.

Nickel and arsenic minerals associated with the uranium will not be recovered. Each mineral will be delivered to the mill tailings area as part of the main tailings stream. The nickel will not be recovered because it is contaminated with radium; there is no market for the arsenic.

Selection of the mill tailings disposal area was one of the most important considerations of the entire project. The area was situated in order to take advantage of topography and soil conditions so that the environment would be fully protected during the life of the project and post operational years as well. Eventually, tailings from the mill will be deposited in two storage sites located one kilometer northwest of the mill site, each carefully prepared with an impervious base of compact till and bentonite (see Figure 3). The entire tailings area will be situated above the natural water table. The tailings slurry will be allowed to build up in successive layers ten centimeters thick. Natural settling and evaporation of moisture will cause consolidation of each layer as it is deposited. The layers will in turn become almost completely impermeable to seal off the lower portions. At the termination of the project, each tailings site will be covered with a final impermeable seal, followed by a layer of soil which will be revegetated. The design and siting of the storage areas provides for total containment of solid and liquid waste material generated by the mining and milling project.

Work Schedule

The remote location of the project area has created other problems relative to a full scale development program. Due to the lack of a readily available labor force, it was necessary for KLMC to generate employment from six native villages in the district and the cities of Prince Albert and Saskatoon. (Much of the Rabbit Lake and Cluff Lake labor force comes from the same general area. On occasion the operating companies will be competing for employees.) Employees will be airlifted to and from the project site by charter aircraft. In each case, twin engine aircraft will be utilized because existing landing strips are unpaved.

An all weather road has been extended from the village of Pinehouse to the site, a distance of 227 kilometers. The road was first opened to traffic in August, 1980. It has served as a supply route since then, eliminating the necessity to use a special winter road which was available only from January through March. The new road was opened to the public this past summer.

The present labor force at Key Lake numbers 250 on construction and 50 on final orebody interpretation and planning. Over half of the current construction force are natives of northern Saskatchewan. The work force will increase to about 1,000 during the peak of construction activity. When mine and mill production begins in 1983, the permanent work force will total about 450 of which at least 50 percent will be natives.

The work schedule is seven days on, seven days off with 11 hours per day on the job. Work crews are rotated and flown to and from the site accordingly. Living accommodations for each employee are available on the site (Figure 3 shows the location of the camp). The current work schedule is expected to continue throughout the life of the project.

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STATISTICAL DATA

EXCHANGE VALUE $23.50/lb. U_3O_8
Determined as of October 31, 1981

Definition

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

Derivation

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.

B. Data from pending transactions.

C. Firm bids to buy and firm offers to sell.

D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

Comments

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.

B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

TRANSACTION VALUE
Determined as of October 31, 1981

$ lb U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
24.10	2.1	10	3

Definition

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U_3O_8 in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds U_3O_8 are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

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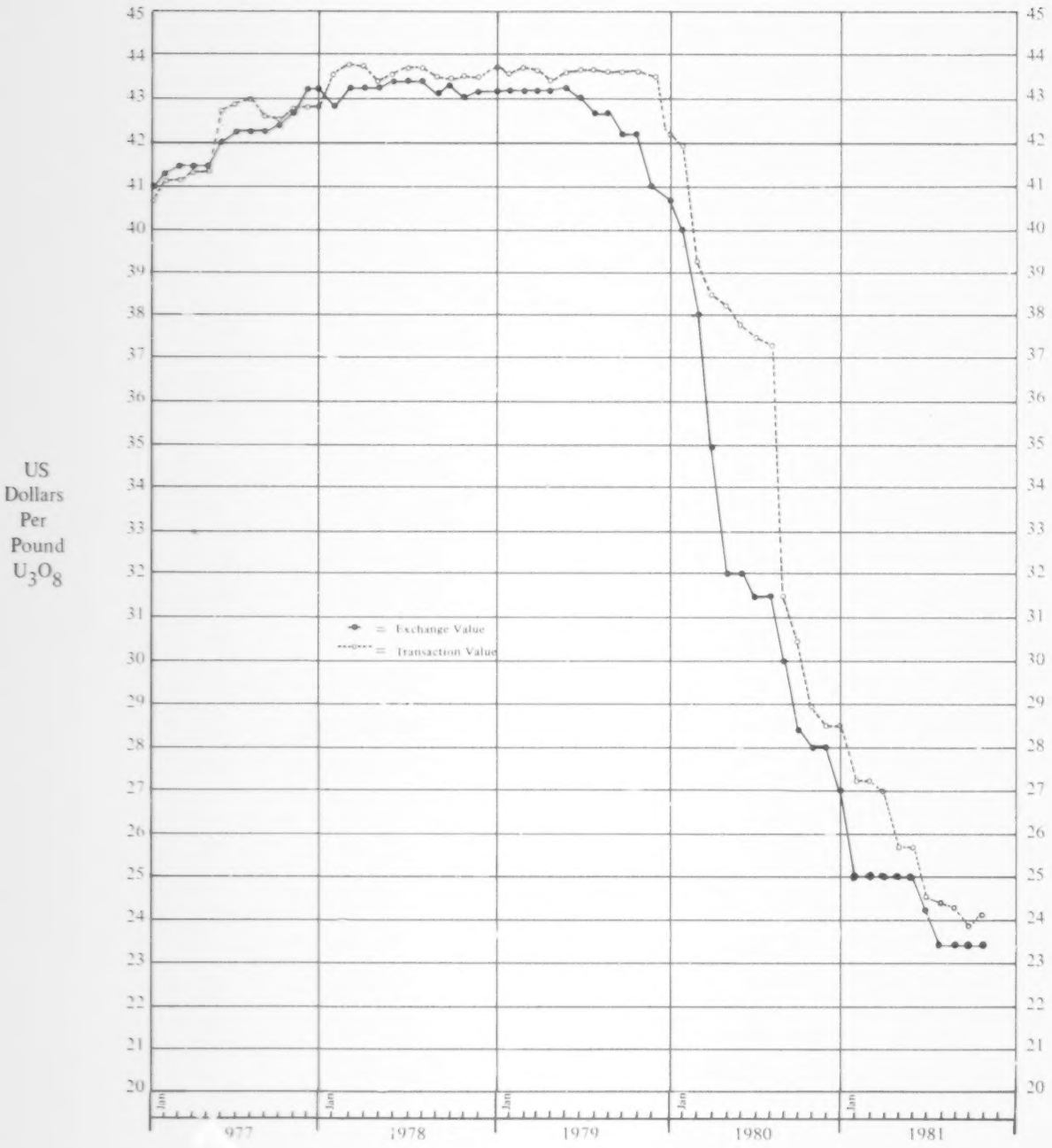
STATISTICAL DATA

EXCHANGE AND TRANSACTION VALUES
SINCE JANUARY 1977

Determined as of the last day of the month indicated



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STATISTICAL DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	–	–	–	–	–	–	–	6.35	6.35	6.40	6.45	6.50
1969	–	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50		

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	–	–	–	–	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10		

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES*

Country	per lb U_3O_8 in Concentrates	per kg U_3O_8 in Concentrates	per kg U in Concentrates
US (dollar)	23.50	51.81	61.09
France (franc)	133.45	294.20	346.93
FRG (mark)	53.12	117.11	138.10
Japan (yen)	5,505	12,136	14,311
Switzerland (franc)	43.48	95.85	113.03
UK (pound)	12.74	28.10	33.13
Australia (dollar)	20.71	45.67	53.85
Canada (dollar)	28.30	62.39	73.57
Niger, Gabon (CFA)	6,672	14,710	17,347
South Africa (rand)	22.64	49.91	58.86
Sweden (kröner)	130.77	288.31	339.98

*Calculated using currency exchange rates published in the Wall Street Journal on the last business day of the month.

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STATISTICAL DATA

CONVERSION VALUE $1.10/lb. U as UF_6
Determined as of October 31, 1981

Definition

The Conversion Value is Nuexco's judgment of the price at which spot and or near term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

Derivation

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.

B. Data from pending transactions.

C. Firm bids to buy and firm offers to sell.

D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

Comments

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.

B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

LOAN USE CHARGE RATE 6%
Determined as of October 31, 1981

Definition

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

Derivation

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.

B. Rates included in firm proposals to borrow or lend.

C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

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STATISTICAL DATA

CURRENT TRANSACTIONS*

Uranium Transactions

Nuexco Reference Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as percent of Current E.V.	Seller Group	Buyer Group	Remarks
1606	1983-84	301-600	94	US	US	
1617	1981	301-600	97	US	Non-US	
1623	1982	101-300	115	US	US	
1637	1981	Less than 50	98	US	US	
1638	1982	301-600	104	US	US	

Conversion Transactions

Nuexco Reference Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price as percent of Current C.V.	Seller Group	Buyer Group	Remarks

none reported

*Transactions listed include not only those in which Nuexco was involved, but also all others of which Nuexco is aware.

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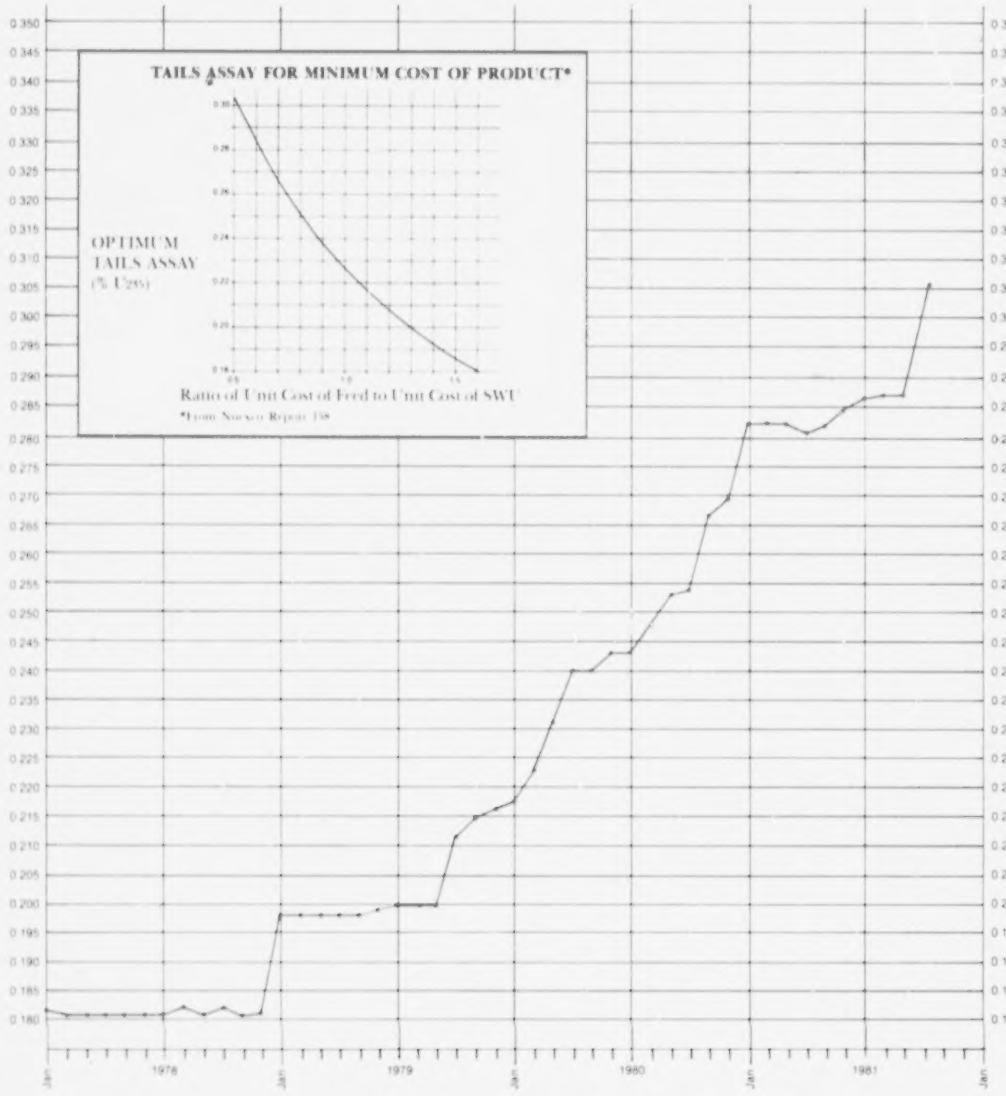
OPTIMUM TAILS ASSAY

The optimum tails assay is the tails composition at which the cost of enriched uranium is lowest for given costs of separative work (SWU) and natural uranium feed. It depends only on the ratio of the cost of a kilogram of natural uranium in the form of UF_6 to the cost of a kilogram unit of separative work. Holders of US Department of Energy (USDOE) Adjustable Fixed Commitment (AFC) enrichment contracts have the option to specify, within limits, the transaction tails assay. The transaction tails assay for USDOE Requirements contracts is 0.2 percent U_{235}. For every one-hundredth of one percent increase in the transaction tails assay, natural uranium consumption increases about two percent.

OPTIMUM TAILS ASSAY[1]



[1]Based on Exchange Value and USDOE AFC SWU price; interpolated to the nearest thousandth.

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STATISTICAL DATA

US GOVERNMENT STATISTICS

	Producer Price Index—Industrial Commodities (1967 = 100)[1]	Producer Price Index—All Commodities (1967 = 100)[1]	Consumer Price Index (1967 = 100)[2]	GNP Implicit Price Deflator (1972 = 100)[3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
					Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
Annual Avg. 1970[5]	110.0	110.4	116.3	91.36	3.88	3.87	3.69	3.28
Annual Avg. 1971[5]	114.1	114.0	121.3	96.02	4.12	4.15	3.97	3.49
Annual Avg. 1972[5]	117.9	119.1	125.3	100.00	4.56	4.59	4.26	3.71
Annual Avg. 1973[5]	125.9	134.7	133.1	105.80	4.84	4.98	4.51	3.91
Annual Avg. 1974[5]	153.8	160.1	147.7	116.02	5.44	5.63	4.88	4.21
Annual Avg. 1975[5]	171.5	174.9	161.2	127.15	6.13	6.24	5.39	4.64
Annual Avg. 1976[5]	182.4	183.0	170.5	133.71	6.76	6.87	5.91	4.96
Annual Avg. 1977[5]	195.1	194.2	181.5	141.70	7.28	7.67	6.43	5.39
Annual Avg. 1978[5]	209.4	209.3	195.4	152.05	8.23	8.56	7.02	5.82
Annual Avg. 1979[5]	236.5	235.6	217.4	165.46	9.27	9.50	7.60	6.32
Annual Avg. 1980[5]	274.8	268.8	246.8	177.36	10.27	10.63	8.30	6.95
Jun 1980	273.5	265.6	247.6	178.93	10.14	10.70	8.25	6.86
Jul 1980	276.2	270.4	247.8	—	10.24	10.83	8.36	6.95
Aug 1980	278.2	273.8	249.4	—	10.39	10.79	8.40	7.01
Sep 1980	278.8	274.6	251.7	182.92	10.55	10.95	8.47	7.12
Oct 1980	282.2	277.8	253.9	—	10.59	11.01	8.53	7.18
Nov 1980	283.4	279.1	256.2	—	10.73	11.07	8.60	7.27
Dec 1980	286.6	280.8	258.4	183.98	10.84	11.32	8.69	7.38
Jan 1981	291.5	284.8	260.5	—	10.91	11.31	8.74	7.41
Feb 1981	295.7	287.6	263.2	—	11.15	11.36	8.80	7.43
Mar 1981	299.6	290.3	265.1	188.14	11.13	11.50	8.84	7.47
Apr 1981	303.5	293.4	266.8	—	11.30	11.63	8.94	7.51
May 1981	304.1	293.7	269.0	—	11.26	11.68	8.99	7.55
Jun 1981	304.7	294.1R	271.3	191.06R	11.31	11.88	9.07	7.60
Jul 1981	306.0	296.0	274.4	—	11.61	12.19	9.16	7.69
Aug 1981	307.0P	296.2P	276.5	—	11.83P	12.13P	9.17P	7.76P
Sep 1981	307.2P	295.5P	279.3	195.40P	—	—	9.34P	7.83P

P = Preliminary R = Revised since last month

[1]US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2]US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3]US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4]US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5]Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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STATISTICAL DATA

AUSTRALIAN GOVERNMENT STATISTICS

	Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1]	Weighted Average Minimum Weekly Wage Rates—Adult Males Australia Mining and Quarrying (A$)[2]
Annual Avg. 1970[3]	101.4	59.88
Annual Avg. 1971[3]	101.5	65.95
Annual Avg. 1972[3]	105.6	71.26
Annual Avg. 1973[3]	124.4	78.96
Annual Avg. 1974[3]	141.9	108.07
Annual Avg. 1975[3]	150.4	132.55
Annual Avg. 1976[3]	168.4	160.93
Annual Avg. 1977[3]	192.0	179.03
Annual Avg. 1978[3]	198.5	190.04
Annual Avg. 1979	248.8	196.34
Annual Avg. 1980	321.8	217.96
Jun 1980	338.8	214.16
Jul 1980	347.8	221.52R
Aug 1980	352.0	220.08
Sep 1980	350.3	219.60
Oct 1980	348.2	221.13
Nov 1980	350.4	221.50R
Dec 1980	351.7	221.81
Jan 1981	357.8	229.97R
Feb 1981	356.6	229.79
Mar 1981	355.2	229.04R
Apr 1981	354.6	228.76R
May 1981	353.4	236.67
Jun 1981	360.4	236.99R
Jul 1981	357.5P	236.85
Aug 1981	360.2P	236.85P

P = Preliminary R = Revised since last month

[1]Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.
[2]Australian Bureau of Statistics, Canberra: "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures for the latest fourteen months shown are subject to revision.
[3]Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

STATISTICAL DATA

CANADIAN GOVERNMENT STATISTICS

	Industry Selling Price Index: Manufacturing (D 500000)[1, 2] (1971 = 100.0)	Wage-earner Data: Average Hourly Earnings ($)[3, 4]		
		Metal Mining, including milling (SIC 050-059)	Primary Metal Industries, non-ferrous (SIC 296-298)	Chemicals and Chemical Products (SIC 370-379)
Annual Avg. 1977	174.3	8.18	6.50	6.51
Annual Avg. 1978	190.4	8.76	6.82	6.97
Annual Avg. 1979	217.9	9.60	7.35	7.67
Annual Avg. 1980	247.2	10.59	8.05	8.50
Jun 1980	243.7	10.51	8.07	8.46
Jul 1980	246.3	10.49	8.11	8.55
Aug 1980	249.4	10.58	8.14	8.65
Sep 1980	252.0	10.85	8.24	8.71
Oct 1980	256.0	11.05	8.28	8.82
Nov 1980	257.8	11.11	8.38	8.77
Dec 1980	258.4	11.13	8.32	8.92
Jan 1981	263.3	11.27	8.51	8.90
Feb 1981	263.7R	11.43	8.59	9.00
Mar 1981	265.5R	11.47	8.63	9.17
Apr 1981	267.8R	11.73	8.76	9.33
May 1981	269.8R	11.80	8.90	9.49
Jun 1981	272.0R	11.80P	9.20P	9.60P
Jul 1981	273.8	11.89P	9.19P	9.64P
Aug 1981	275.2P	—	—	—

P = Preliminary R = Revised since last month

[1]Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2]Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3]Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[4]Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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STATISTICAL DATA

REPUBLIC OF SOUTH AFRICA STATISTICS

	Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Consumer Price Index[2] (1975 = 100, except where otherwise indicated)	Wholesale Price Index All Groups (1975 = 100)	Total Employment in Mining and Quarrying (Code 35)[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[5]
Annual Avg. 1970[3]	7.34	100.3[4]	—	655,346	399,164
Annual Avg. 1971[3]	7.88	106.4[4]	59.1	652,291	415,956
Annual Avg. 1972[3]	8.79	113.3[4]	63.9	623,067	443,933
Annual Avg. 1973[3]	10.51	124.1[4]	72.3	684,743	572,133
Annual Avg. 1974[3]	13.18	138.5[4]	85.3	674,140	761,536
Annual Avg. 1975[3]	16.71	157.2[4]	100.0	639,473	1,003,617
Annual Avg. 1976[3]	19.30	174.7[4]	115.1	671,240	1,212,983
Annual Avg. 1977[3] [6]	23.87	194.4[4]	130.0	712,006	1,420,670
Annual Avg. 1978[3] [6]	27.14	137.2	142.7	664,571	1,537,169
Annual Avg. 1979[3] [6]	30.18	155.3	161.5	692,209	1,830,632
Annual Avg. 1980[6]	35.53	176.7	192.1	714,379	2,279,615
Jun 1980	34.48	174.6	189.0	714,379	183,739
Jul 1980	—	177.2	192.7	715,460	202,403
Aug 1980	—	179.2	196.8	716,486	206,514
Sep 1980	36.19	182.8	199.8	710,889	204,761
Oct 1980	—	186.3	203.1	720,246	204,602
Nov 1980	—	187.8	205.6	716,797	208,345
Dec 1980	37.69	189.9	206.5	705,087	211,829
Jan 1981	—	191.0	207.2	729,575	219,969
Feb 1981	—	193.8	209.8	725,647	210,275
Mar 1981	39.26	195.2	209.9	705,010	210,151
Apr 1981	—	196.4	211.6	719,674	217,124
May 1981	—	197.7	213.2	726,869	219,880
Jun 1981	40.41	200.0	215.3	728,506	237,049
Jul 1981	—	204.6	218.4	735,839	249,080
Aug 1981	—	208.0	222.6	—	—

[1]Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.
[2]Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."
[3]Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 19 of Nuexco Report 140.
[4]April 1970 = 100.00.
[5]Bulletin of Statistics, Department of Statistics, Pretoria.
[6]Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.

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MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

URANIUM SUPPLY

Nuexco Reference Number	Delivery Period* (Thousands of Pounds U_3O_8) 0 to 1 Year	1 to 2 Years	2 to 3 Years	Remarks
Available for Sale:				
1475	1000			UF_6
1480	200	300	300	
1490	1000			
1575			500	Long Term
1589	350			
1581	100	150	150	Long Term
1600			200	Long Term
1610	300	100		
1637	500	500		
1678		275		
1684	500			UF_6
1698	30			
1727	500			
1738	750			UF_6
1741	500			
1743	100	100	100	Long Term
1749	350	200	200	
1770	500			
1774	50			
1804	550			
1807	700			
1810	750			
TOTAL:	8730	1625	1450	
Available for Loan:				
1429	300			UF_6
1695	225	325	325	UF_6
1742	500			
TOTAL:	1025	325	325	

*Measured from the date of this Report.

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MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

URANIUM DEMAND

Nuexco Reference Number	Delivery Period* (Thousands of Pounds U3O8) 0 to 1 Year	1 to 2 Years	2 to 3 Years	Remarks
Inquiries to Purchase:				
1459			200	Long Term
1462			100	Long Term
1603		100	100	Long Term
1634		400		
1699	950	300	250	
1704		200	200	Long Term
1717	200			
1724	600	500	500	Long Term
1732	50			
1744	1000			
1762	300			
1769	125			UF_6
1771	500			
1775	20			
1802	100	100	100	
1806	500	500	250	
TOTAL:	4345	2100	1700	
Inquiries to Borrow:				
1621	300			
1780	500			
TOTAL:	800			

*Measured from the date of this Report.

MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the secondary market for UF_6 conversion services. The data presented in this section are in no way intended to be indicative of the entire market for the time period covered.

CONVERSION SUPPLY

Nuexco Reference Number	Delivery Period* (Thousands of Pounds U as UF_6) 0 to 1 Year	1 to 2 Years	2 to 3 Years	Remarks
1451	75			
1584	350	300	300	Long Term
1607	1000			
1609	500	1500	1000	Long Term
1619		200	100	
1661		200	200	Long Term
1684	450			
1764	100			
TOTAL:	2475	2200	1600	

CONVERSION DEMAND

Nuexco Reference Number	Delivery Period* (Thousands of Pounds U as UF_6) 0 to 1 Year	1 to 2 Years	2 to 3 Years	Remarks
1594		400	950	Long Term
1622	200	300	300	Long Term
1776			200	Long Term
1779	200			
TOTAL:	400	700	1450	

*Measured from the date of this Report.

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